



# Airspace Operations and Safety and Integrated Flight Systems

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# Airspace Operations and Safety

## Airspace Operations and Safety A3

- Seeks innovative and feasible concepts to enable significant increases in the capacity and efficiency of the Next Generation Air Transportation System (NextGen), and future capabilities that go beyond NextGen, while maintaining or improving safety and environmental acceptability
- Comprised of 3 Sub-topics
  - Advanced Air Traffic Management System Concepts A3.01
  - Future Aviation Systems Safety A3.02
  - Autonomy of the National Airspace System (NAS) A3.03
- Sub-topics directly align with ARMD Strategic Thrusts outlined in ARMD Strategic Plan
  - *Safe Efficient Growth in Global Operations* (Thrust #1)
  - *Real-Time System-Wide Safety Assurance* (Thrust #5)
  - *Assured Autonomy for Aviation* (Thrust #6)

# Advanced Air Traffic Management System Concepts A3.01

- Advanced Air Traffic Management System Concepts directly supports ARMD Strategic Thrust #1, *Safe Efficient Growth in Global Operations*
- Focused on conducting the research and development for enabling a modernized air transportation system that will achieve much greater capacity and operational efficiency, while maintaining safety and environmental constraints
- Research Themes identified in Thrust #1 focus on
  - Advanced Operational Concepts, Technologies, and Automation
    - R&D of operational efficiency incorporating proactive safety risk management in operational domains
  - Safety Management for Emergent Risks
    - R&D of prognostic safety risk management solutions and concepts for emergent risks
  - Integrated Modeling, Simulation, and Testing
    - Development, validation, and application of advanced modeling, simulation, and testing capabilities to assess integrated, end-to-end NextGen trajectory based operations functionality, as well as seamless UAS operations and other future aviation system concepts and architectures
  - Airspace Operations Performance Enablers
    - Advanced research to develop performance requirements and guidelines for enablers including operational guidelines and standards for new vehicles (such as UAS), secure CNSI infrastructure requirements, and reliable assurance requirements of safety critical software

# Future Aviation Systems Safety A3.02

- Future Aviation Systems Safety directly supports ARMD Strategic Thrust #5, Real-Time System-Wide Safety Assurance (RSSA)
- Focused on ensuring that commercial aviation remains as the safest mode of travel in the US building on decades of continuous improvement through proactively managing hazards, incidents, and risks of accidents.
- Research Themes identified in Thrust #5 focus on
  - Continuous System-wide Safety Awareness (Monitor)  
R&D of technical approaches and required architecture to support comprehensive safety monitoring through acquisition, integration and assurance of sensitive data from heterogeneous sources.
  - Safety Risk Identification and Evaluation (Assess)  
R&D of Assured tools that improve the accuracy of real-time detection, diagnosis and prediction of hazardous states and the impact of these states on system safety.
  - Integrated Coordinated Prevention, Mitigation and Recovery (Mitigate)  
R&D of Trusted methods for dynamic, multi-agent planning, evaluation, and execution of real-time risk mitigating response to hazardous events.
  - Airspace Experimentation, Demonstration and Assessment  
Experimentation, demonstration, benefits analysis and transition of new RSSA technologies within all elements of the airspace.

# Autonomy of the National Airspace System (NAS) A3.03

- *Autonomy of the National Airspace System (NAS)* directly supports ARMD Strategic Thrust #6, Assured Autonomy for Aviation
- Focused on enabling autonomous systems that employ highly intelligent machines to maximize the benefits of aviation to society.
- Research Themes identified in Thrust #6 focus on
  - Technologies and Methods for Design of Complex Autonomous Systems  
Methods and technologies for design of intelligent machine systems capable of operating and collaborating in complex environments
  - Assurance, Verification, and Validation of Autonomous Systems  
Methods for certification and assuring trustworthiness in the design and operation of autonomous systems
  - Human-Autonomy Teaming in Complex Aviation Systems  
Optimal human-machine role assignments and teaming strategies for increasing machine autonomy and earned levels of trust
  - Implementation and Integration of Autonomous Airspace and Vehicle Systems  
Novel real-world autonomy applications and transition paths toward higher levels of autonomy
  - Technologies and Methods for Design of Complex Autonomous Systems  
Metrics, models, simulation capabilities, and testbeds for assessment of autonomous systems in laboratory and operational settings.

# Airspace Operations and Safety

Additional information:

Website for Roadmaps and Strategic Plan

<http://www.aeronautics.nasa.gov/strategic-plan.htm>

# Integrated Flight Systems

## Integrated Flight Systems A2

*“Without flight demonstration of advanced concepts and technologies, industry will not take the high risk of commercial development, and full energy efficiency and noise performance goals will not be met”<sup>1</sup>*

- Two Sub-topics
  - Flight Test and Measurement Technologies (A2.01)
  - Unmanned Aircraft Systems Technology (A2.02)
- Relevant ARMD Strategic Thrusts
  - *Innovation in Commercial Supersonic Aircraft* (Thrust #2)
  - *Ultra-Efficient Commercial Vehicles* (Thrust #3)
  - *Transition to Low-Carbon Propulsion* (Thrust #4)
  - *Real-Time System Wide-Safety Assurance* (Thrust #5)
  - *Assured Autonomy for Aviation* (Thrust #6)
- Goals
  - Transition advanced technologies into future aeronautics systems
  - Demonstrate technology benefits in an operationally relevant environment
  - Reduce implementation risk for stakeholders in the aviation community

<sup>1</sup>. NASA ARMD Strategic Implementation Plan

# Flight Test and Measurement Technologies

## A2.01

- Flight Test and Measurement Technologies helps enable ARMD Strategic Thrusts 2, 3 and 4
  - *Innovation in Commercial Supersonic Aircraft* (Thrust #2)
  - *Ultra-Efficient Commercial Vehicles* (Thrust #3)
  - *Transition to Low-Carbon Propulsion* (Thrust #4)
- Goals
  - Explore and develop novel flight test techniques and technologies
  - Advance data acquisition technologies → higher accuracy, improved reliability, increased robustness, etc.
  - Enable flight test in variety of flight test regimes and vehicle types
  - Enhance flight test capabilities of government and industry facilities

# Unmanned Aircraft Systems Technology

## A2.02

- Unmanned Aircraft Systems Technology primarily supports ARMD Strategic Thrusts 5 and 6
  - *Real-Time System Wide-Safety Assurance* (Thrust #5)
  - *Assured Autonomy for Aviation* (Thrust #6)
- Goals
  - Safely enable increased use of unmanned systems in the national airspace
    - Verification, Validation and Certification of Complex Systems
    - Multi-Vehicle Cooperation and Interoperability
  - Demonstrate benefits of autonomy in aviation
    - Human-Autonomy Teaming
    - Health Management and Fault Detection
    - Autonomous Decision Making